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Approved For Release 2005/05/20 : CIA-RDP78B04770A001600010009-6

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*Retention on security*  
*Proj. 997093*  
16 December 1963

PERFORMANCE REQUIREMENTS  
FOR  
HIGH RESOLUTION STEP AND REPEAT CONTACT PRINTER

1. SCOPE

1.1. Scope - These performance requirements cover a high-precision, automatically operated, step and repeat contact roll printer, capable of producing photographic exposures of the highest possible quality, resolution, and acutance, from roll film widths varying from 70mm to 9 $\frac{1}{2}$  inches in any selected frame lengths from 2 $\frac{1}{4}$  inches up to a maximum of 30 inches.

1.2. Development Plan - The development plan shall be carried out in the following three phases:

1.2.1. Feasibility Study. The contractor shall submit a feasibility report for approval. The report shall present the characteristics and components required to meet the performance requirements specified herein and the proposed methods of accomplishment.

1.2.2. Breadboard Phase. The breadboard phase shall demonstrate the feasibility of the concepts employed. The breadboard model shall be reviewed and approved by the contract monitor before proceeding with fabrication of the prototype. Approval of the breadboard shall not relieve the contractor of his responsibility to fulfill the requirements specified herein.

1.2.3. Prototype Phase. The prototype phase shall encompass final design, fabrication and testing of the finished deliverable product.

2. REQUIREMENTS

2.1. General. The automatic step and repeat contact printer specified herein shall be an electrically operated, single-unit, enclosed, daylight-

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GROUP 1  
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operating, floor model requiring no installation other than connection to an electric power source. The principle use of the printer will be to produce duplicate contact prints on roll film from aerial roll negatives.

2.1.1. The prime objective of this development is to produce a printer capable of the maximum modulation transfer function, in terms of the modulation transfer characteristics of the reproduction material, with a reasonably high recycling rate and an operating flexibility to permit multiple exposures from a single negative frame and selective printing of single frames. A secondary objective is to print color transparencies and opaque color prints from original color transparencies.

2.1.2. Automatic exposure control is required. Automatic dodging in conjunction with exposure control is desirable but not a firm requirement.

2.1.3. Negative Frame Coding. An optional system shall be devised for applying appropriate and removable frame marking or coding of selected negative frames. This coding or marking system shall be keyed to the printer in such a manner that the printer will print those frames only and exclude the printing of those not marked or coded.

2.2. Materials. All materials employed in the printer shall be of the highest quality and shall be corrosion resistant or properly treated to resist corrosion.

2.3. Cabinet Enclosure. The entire printer shall be contained within a single protective cabinet. The function of the cabinet shall be to provide a daylight operating unit having a clean room interior atmosphere, during its operation. The cabinet shall be as small as possible, consistent with the requirements.

2.3.2. Interior Environment. The cabinet shall be pressurized with filtered air to prevent entry of dust particles. Input air shall be

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filtered to a particle size not greater than 0.3 micron in diameter. Temperature and humidity within the cabinet shall be maintained at  $70^{\circ} \pm 2^{\circ}\text{F}$ . and  $50\% \pm 5\%$  relative humidity in an outside environment of approximately  $70^{\circ}$  to  $80^{\circ}\text{F}$ . and relative humidity of 40% to 70%.

2.4. Film Accommodation. The printer shall properly accommodate the following in all respects:

2.4.1. Film Widths. 70mm, 5 inch, 6.6 inch, 8 inch and  $9\frac{1}{2}$  inch.

2.4.2. Film Lengths. Film rolls up to 1000 feet of negative film and print film respectively.

2.4.3. Film Thicknesses. From 2.0 to 7.5 mils.

2.4.4. Representative Film Types. 8430, 5427, 8402, S0130 and standard color films balanced for daylight and/or incandescent illumination.

2.4.5. Spools. "Mil Standard" flanged spools of required flange diameters to accommodate the films described under paragraphs 2.4.1. to 2.4.4. inclusive.

2.4.6. Paper Accommodation. The printer shall also accommodate standard weight opaque color print materials and single weight B&W print materials. The sizes and lengths shall be as specified above. This requirement, however, shall not compromise satisfaction of the prime requirements set forth for transparency materials.

2.5. Print Format. The printer shall produce prints (in dynamic mode) in any nominal format size from a minimum of  $2\frac{1}{4} \times 2\frac{1}{4}$  inches to a maximum of  $9\frac{1}{2} \times 30$  inches, as well as any selected intermediate format size. Format sizes shall in all cases include fiducial marks and edge numbering.

2.6. Printing Rate. The printer shall have the capability of automatic printing at any selectable rate from one (1) frame per minute (2.5 fpm) to a maximum of not less than ten (10) frames per minute, or the equivalent

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maximum of 25 fpm. Optional manual control of the printer cycling rate shall also be provided. Specified requirements for maximum quality and resolution shall be maintained, regardless of cycling rate.

2.7. Evenness of Illumination. Evenness of illumination shall be such that flash exposures produced by the printer and developed to a density of 1.0 under ideal conditions shall not vary in density across the film width by more than 0.04 density units. There shall be no streaking whatever.

2.8. Resolution. The printer, in its dynamic mode, shall be capable of consistently producing exposures of not less than 400 lpm from original targets of 1000:1 contrast ratio and resolving a maximum of 800 lpm. This resolution requirement shall apply over the entire format of each specified size. This requirement will not apply to color materials.

2.9. Contrast. The printer shall produce a contrast slope of not less than 1.35 when exposed to an A-1 step tablet original on type 8430 film and processed according to manufacturer's recommendations.

2.10. Splice Accommodation. The printer shall accommodate film rolls with film splices of the type normally used by principle manufacturers of aerial film and good quality hand splices.

2.11. Newton Rings. The printer shall not produce newton rings.

2.12. Film Damage. The printer shall not damage the film base or emulsion of original negative or print material in any manner whatsoever, including damage that may be caused by static electricity.

2.13. Film Contact. The printer shall provide near absolute contact over the entire printing format at all cycling rates and all operating modes.

2.14. Distortion. Prints from the printer shall not differ dimensionally from the original negatives in any direction by more than .01% with respect to the original at any place in the format.

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2.15. Film Cleaning. Provision shall be made for vacuum cleaning of the film before it enters the print platen.

2.16. Reliability. The printer shall be designed for a 90% duty cycle and shall operate satisfactorily and properly in all respects for continuous periods of not less than 10 hours without malfunction or breakdown while transporting both negative film (leader) and print film (leader). After the endurance run, the printer shall produce prints meeting the requirements specified herein.

2.17. Human Engineering. The printer design and fabrication shall exhibit the highest possible degree of human engineering consistent with the specified requirements.

2.18. Vibration. Suitable vibration isolation shall be provided for the printer and its significant components to minimize adverse effects of vibrations from external sources and from internal sources.

2.19. Light Source. The light source or light sources shall be entirely suitable, appropriate, and adequate for the purpose to fulfill the prime requirements of maximum print quality, resolution and acutance.

2.19.1. It is suggested that consideration also be given to:  
(Not firm requirements)

2.19.1.1. Collimation of the light source or sources.

2.19.1.2. Interchangeability of light sources to facilitate selection of sources with peak emissions corresponding to the sensitivity of materials being exposed.

2.19.1.3. Filter accommodation to permit color balance of the source to suit the spectral sensitivity or color balance of print materials.

2.19.1.4. A traveling light source across the length of the print frame.

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2.19.1.5. Sources that permit modulation and/or attenuation for purposes of print dodging and/or exposure control.

2.19.1.6. Optical compensators or correctors to achieve even illumination.

2.20. Automatic Exposure Control. The printer shall have appropriate, accurate and automatic exposure control capable of properly compensating for overexposed and/or underexposed original negatives.

2.21. Automatic Dodging. (Not a firm requirement) It is desired that an automatic dodging capability also be incorporated in the printer. It would be highly desirable to combine the automatic dodging capability with the automatic exposure control. This capability, however, shall not detract from the prime requirements for maximum quality, resolution, and acutance.

2.22. Control Panel. The printer shall have a suitable control panel properly recessed in the cabinet enclosure but readily accessible. All controls shall be appropriately marked.

2.22.1. Indicators. The control panel shall include indicators for lamp, brightness and color temperature.

2.22.2. Printer Controls. All controls necessary for satisfactory and proper operation of the printer shall be provided. These shall include a capability for automatic multiple printing of any number of duplicate prints from one (1) to forty (40) from any selected negative frame; automatic single or multiple printing of any preset number of frames; and manual control to allow unlimited selective printing of selected frames.

2.22.3. Reverse Winding. Provision shall be made for bi-directional winding at any selected slew speed from 0 to 100 fpm.

2.22.4. Print Counters. Two counters shall be provided. One shall be a six (6) digit non-resettable counter for counting the total life-

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time recycling of the printer. The second shall be a four (4) digit resettable counter for counting the prints exposed in any given run.

2.23. Electrical Requirements. The printer shall operate from a 120-208 volt, 60 cycle, 3 phase, 4-wire power supply. Data showing required electrical data shall be securely affixed in a conspicuous place near the main power input to the printer.

2.23.1. Safety Interlocks. Suitable safety interlocks shall be provided in the printer to preclude any possible damage to original materials (negatives) in case of printer malfunction, film break or material run-out.

2.23.2. Fusing. The printer and its major operating components shall be provided with suitable circuit breakers to prevent damage to the printer in the event of electrical failure.

2.23.3. Color Coding. All electrical wiring shall be color coded to permit circuit tracing.

2.23.4. Circuit Diagram. A circuit diagram shall be permanently affixed to an accessible interior panel of the printer.

2.23.5. Voltage Stabilization. Proper and adequate voltage stabilization shall be provided within the printer to assure consistent and stable functioning of all operational components.

2.23.6. Radio Interference Suppression. The printer shall be equipped with proper suppression of radio interference in accordance with requirements of Specification MIL-S-11748.

2.24. Operational and Maintenance Manual. Five copies of an operational and maintenance manual shall be provided with the printer describing operational characteristics as well as normal maintenance and repair procedures.

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3. TEST PROVISIONS

3.1. Test Plan. Sixty (60) days prior to completion of the printer, the contractor shall submit a detailed test plan to the project monitor for approval. The test plan shall specify and describe tests to be conducted at the contractor's plant to determine conformance to the requirements. The project monitor reserves the right to modify or amplify the test plan to assure adequate testing.

3.2. Furnishing of Test Targets, Films, and Instruments. All test targets, test films and test instruments necessary to demonstrate and test fulfillment of performance requirements of the printer shall be provided by the contractor.

3.3. Pre-Shipment Tests. Prior to delivery, tests as set forth in the test plan shall be conducted by the contractor at the contractor's plant under the direction of the contract monitor. All materials and equipment required for tests shall be furnished by the contractor and shall be approved by the contract monitor. A detailed report of the test results shall be delivered with the printer. Approval of pre-shipment test results shall not constitute final acceptance of the printer.

3.4. Acceptance Tests. Acceptance tests will be performed at the delivery destination and will include a 30 day period of normal operation under production conditions.

4. DELIVERY.

Delivery shall be as specified in the procurement document.

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